NASA's
Materials and Processes Technology Information System (MAPTIS):

How it relates to
Sustainable Aerospace Advanced Manufacturing and Sustainable Materials Management

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29 November 2011
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Session 1B – National and International Regulatory Impacts on DoD Operations:
Refining the Goals of DoD's Strategic Plan for 'REACH'

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14. ABSTRACT
Our poster shows how MAPTIS relates to Sustainable Aerospace Advanced Manufacturing and Sustainable Materials Management. MAPTIS is a ?pre-Milestone B? design-engineering tool. MAPTIS provides materials and manufacturing processes information to design-engineers. One component of MAPTIS provides Environmental-Safety-Health (ESH) information on regulated materials, most notably information on materials regulated by the European Union?s ?REACH? and U.S. ESH regulations. MAPTIS?s ESH component is a powerful way to do Pollution Prevention ?at the Source?. The presentation will provide an overview of: (1) the importance of MAPTIS and the ESH component to the U.S. Aerospace Sector; (2) the relevance of MAPTIS and the ESH component to National and International initiatives; (3) the process for keeping MAPTIS and the ESH information current.

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NASA'S MATERIALS AND PROCESSES TECHNOLOGY INFORMATION SYSTEM (MAPTIS)

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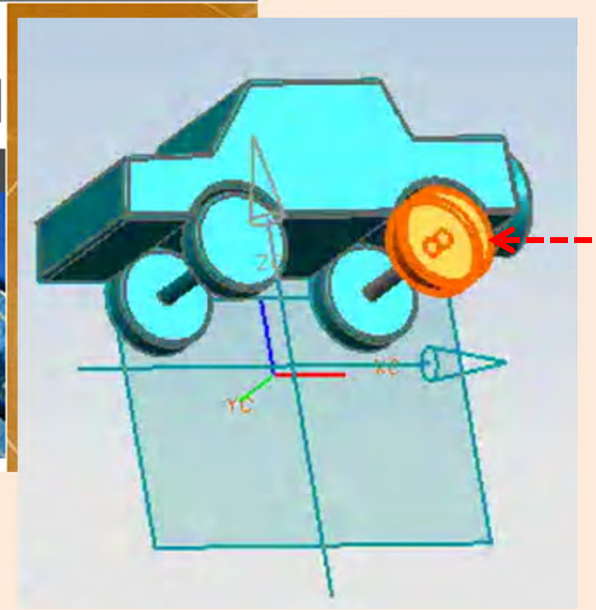
Our poster shows how MAPTIS relates to Sustainable Aerospace Advanced Manufacturing and Sustainable Materials Management.

MAPTIS is a "pre-Milestone B" design-engineering tool. MAPTIS provides materials and manufacturing processes information to design-engineers. One component of MAPTIS provides Environmental-Safety-Health (ESH) information on regulated materials, most notably information on materials regulated by the European Union's 'REACH' and U.S. ESH regulations. MAPTIS's ESH component is a powerful way to do Pollution Prevention "at the Source". The presentation will provide an overview of: (1) the importance of MAPTIS and the ESH component to the U.S. Aerospace Sector; (2) the relevance of MAPTIS and the ESH component to National and International initiatives; (3) the process for keeping MAPTIS and the ESH information current.

NASA is about creating for the future using design-engineering tools to enhance sustainable use of materials and sustainable manufacturing processes



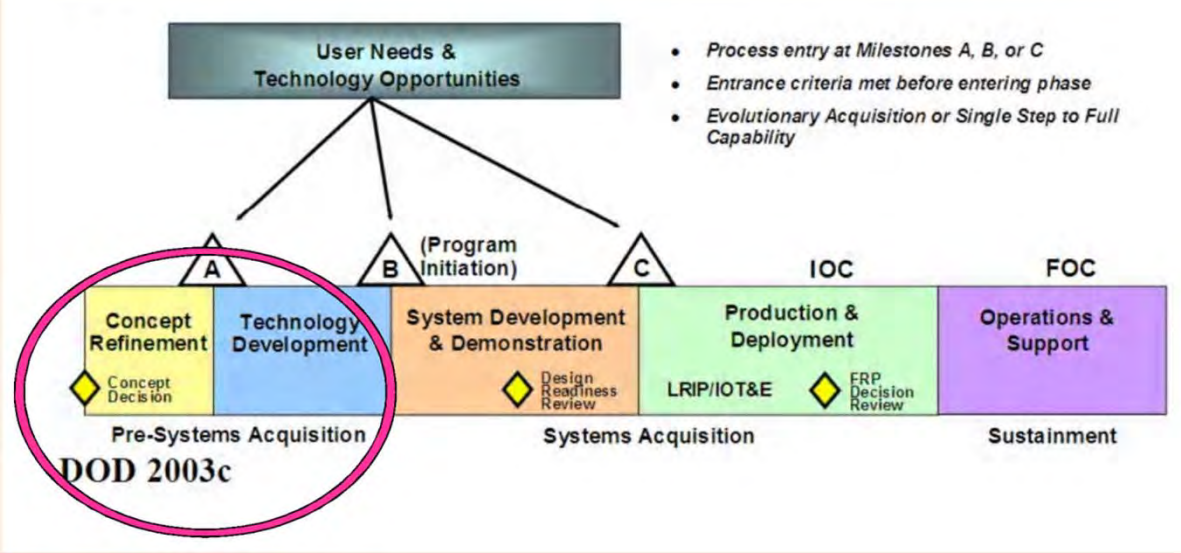
MAPTIS: Materials and Processes Technical Information System
MAPTIS is a NASA Materials Science & Materials Engineering Portal

MAPTIS can be used to locate <u>design problems</u> before they become <u>product problems</u>.

MAPTIS can be used to find the right materials and the right manufacturing processes to give the right performance for the right applications so as <u>not to endanger humans or the planet</u>.

MAPTIS is (in DOD Terminology) **pre-Milestone B:**

"Technical Requirements, before Milestone B"



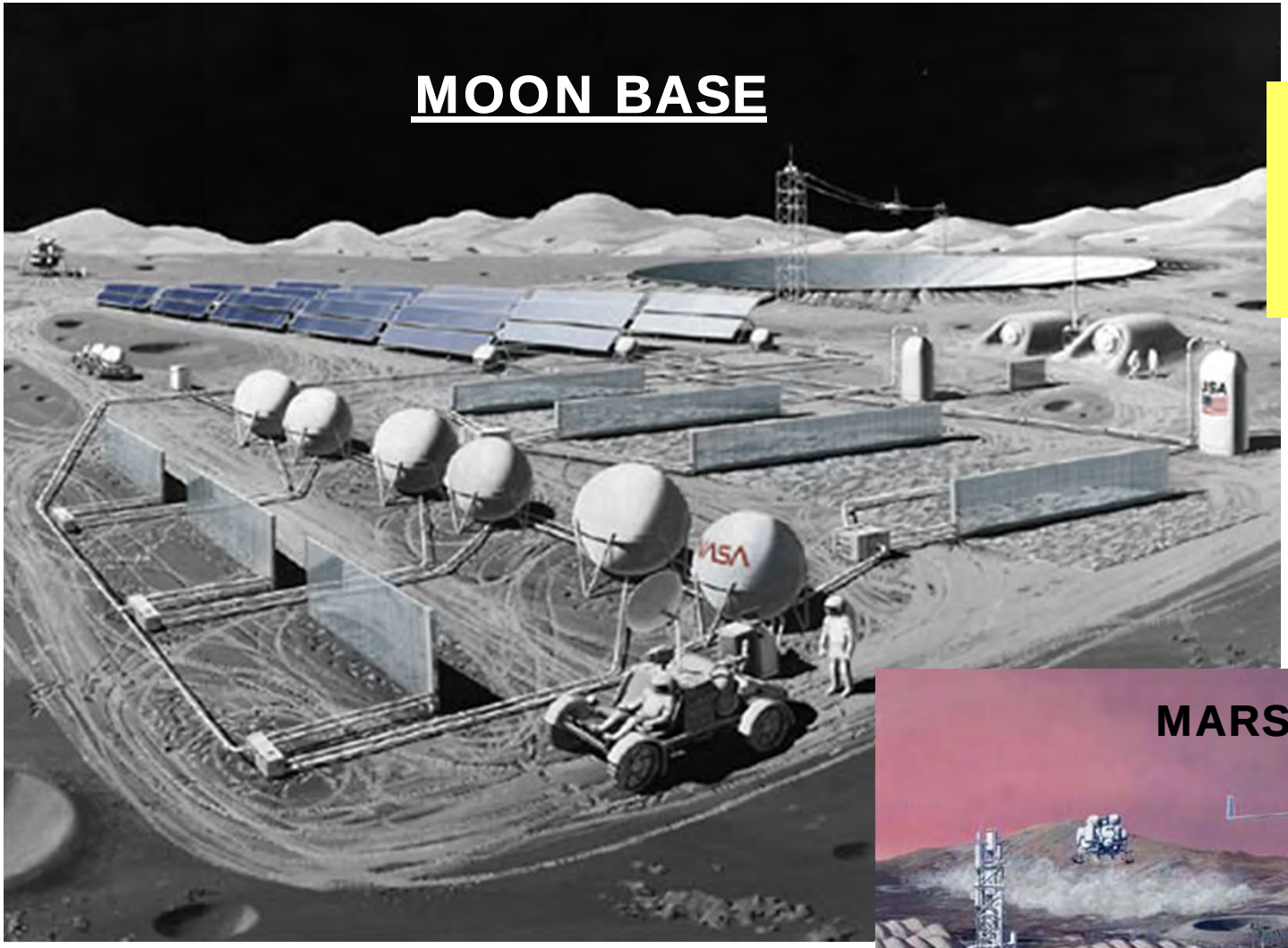
http://www.expressnightout.com/printedition/PDF/EXPRESS_10062011.pdf

http://www.msa.md.gov/msa/mdmanual/01glance/symbols/images/1198-1-542b.jpg

http://apps.atlantaga.gov/citycouncil/Members/ctmartin/gallery_photos/images/YF-horse3_jpg.jpg

REMOTE SITE RESEARCH:

"THE DREAM"



http://www.nasa.gov/centers/glenn/images/content/101885main_C91_08781_516x387.jpg

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MATERIALS MANAGEMENT

REMOTE SITE RESEARCH: *"THE REALITY"*

www.cep.aq/default. asp?casid=6896

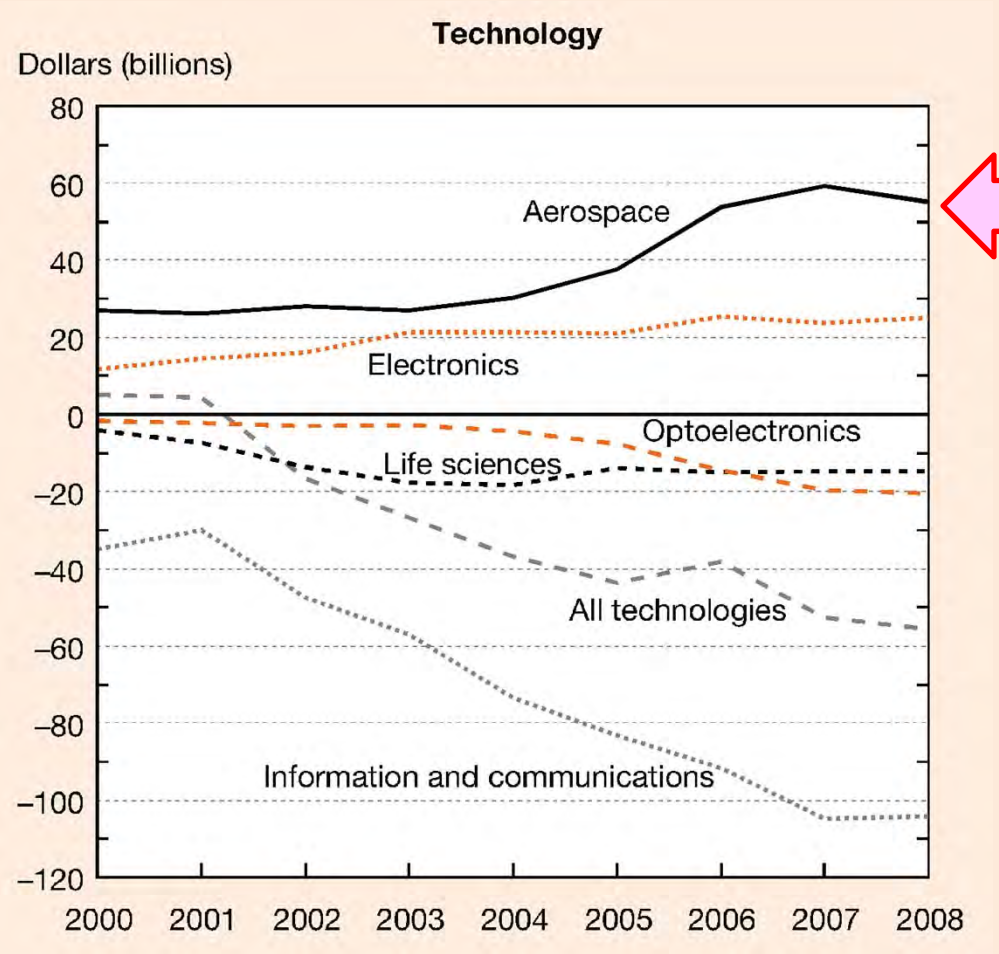
http://web.archive.org/web/20051125095443/www.antarctica.ac.uk/About_BAS/Cambridge/Divisions/EID/Environment/fb_before.jpg

http://response.restoration.noaa.gov/pribilof/

How Important is the US Aerospace Industry?

1) Positive U.S. trade balance only exists for two of the five High-Technology areas*
2) Greatest positive contributor to the Trade Balance is the U.S. Aerospace Sector

* US Trade Balance for Five High-Technology areas defined by OEDC
(National Science Board - National Science Foundation (2010) Science and Engineering Indicators 2010, Chapter 6: "Industry, Technology, and the Global Marketplace", page 6-37,
at URL: http://www.nsf.gov/statistics/seind10/pdf/c06.pdf)



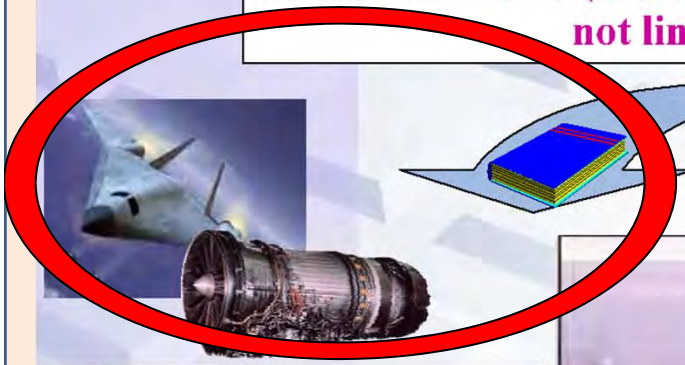
US Trade Balance
Only positive for:

1) Aerospace ~$55B
2) Electronics (includes Avionics) ~$25B

Cost - Schedule - Performance
MAPTIS as part of the solution

What is the Problem?

Materials efforts (new compositions, processing, manufacturing) are not linked with the design process.



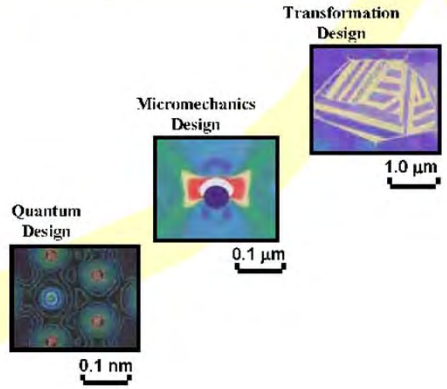
Materials Engineer

Systems Design

- Materials Input from "Knowledge Base" of Data (Data Sheets, Graphs, Heuristics, Experience, etc.)
- System/Sub-System Design is Heavily Computational and Rapid
- Clean Sheet of Paper to Engine Design - 30 Months
- Well Established Testing

Materials Development

- Highly Empirical
- Testing Independent of Use
- Existing Models Unlinked

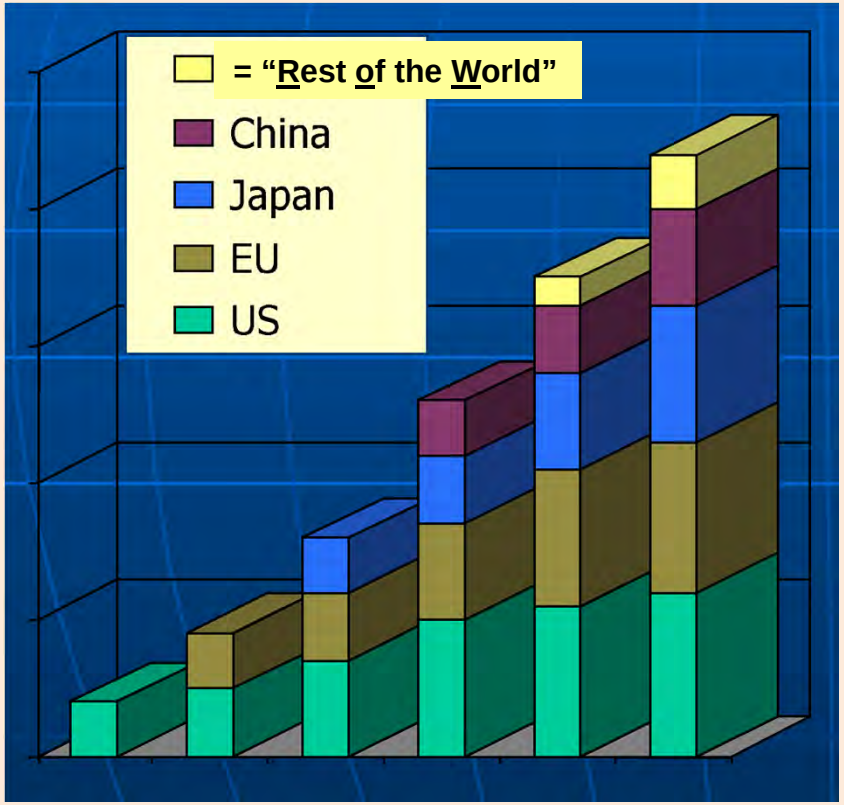


Leo Christodoulou DARPA DSO (2007)
"Accelerated Insertion of Materials (AIM)"

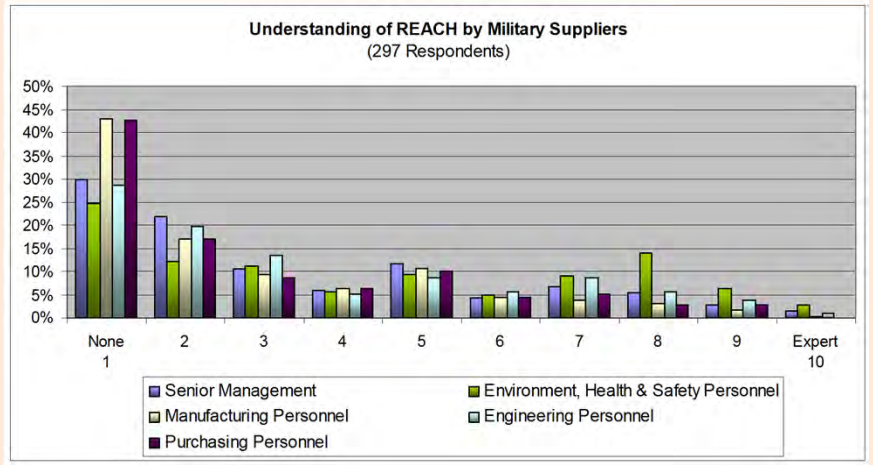
"New commercial products today have a faster development cycle …. For example, jet engines are now developed in 30 months rather than 60, largely because of improved computational design tools." *NRC (2001)* Materials in the New Millennium, at page 10.

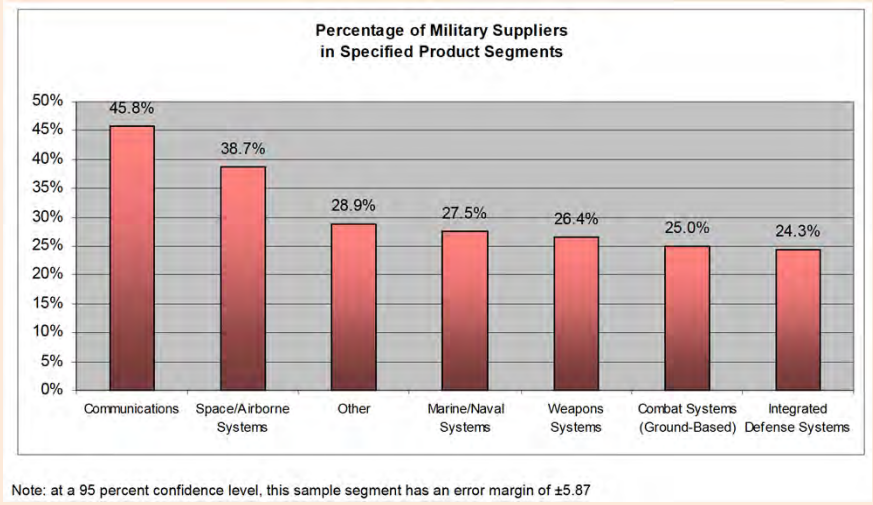
2001 Increasing Global Regulations; and 2008 Lack of Understanding About REACH, U.S. Survey

Apparent "Market Failure" to understand the importance of REACH to the U.S.



Brian Sherwin (CSP co-Founder, EORM / President, ESHconnect)
&
Jen Jeng (Associate EHS Consultant, EORM) (October 2001)
"SESHA Academic Lecture Series: Design for Safety/ Design for the Environment in the Semiconductor Industry"



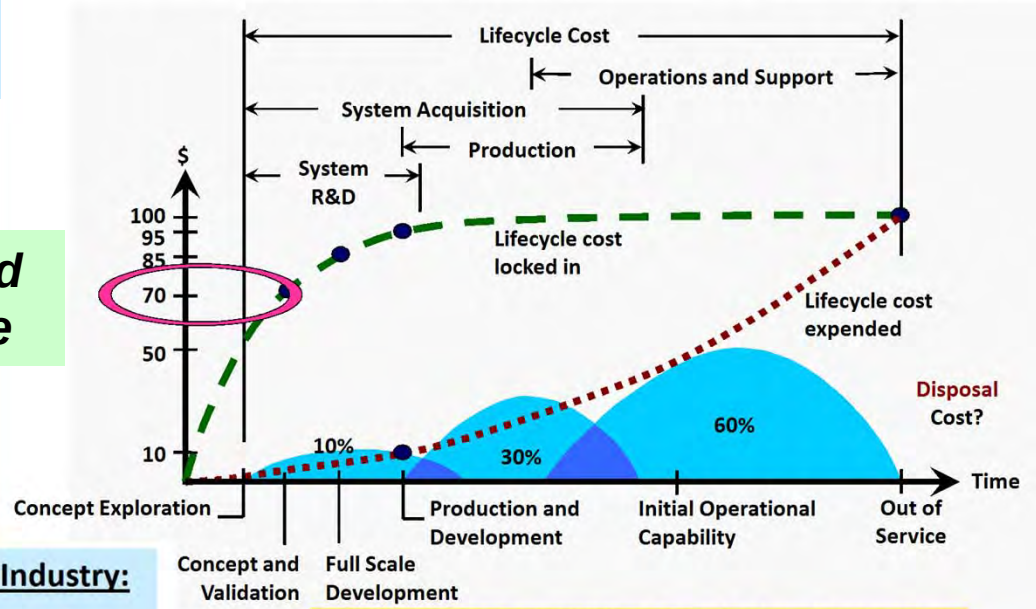


IPC Market Research (2008) "Results of IPC Survey on REACH Preparedness in the North American and European Electronic Interconnect Industry"

Cost locked in by Phase, and Cost of Change by Phase

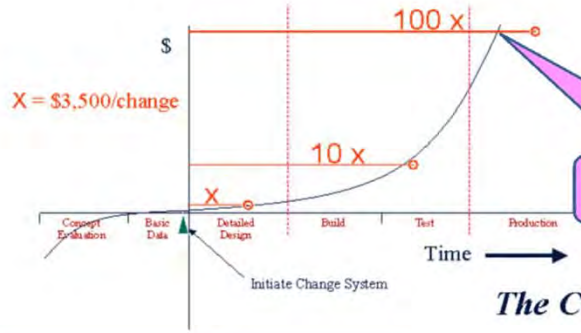
70% of Costs Locked in by Phase

Percentage of Cost Locked In by Phase



From W. J. Larson & L. K. Prance (1999) Human Spaceflight: Mission Analysis and Design

The Cost of Change



Aerospace Industry:

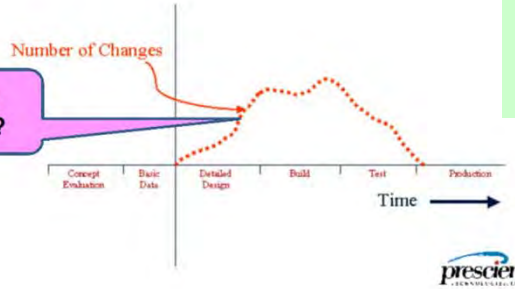
Change Order Cost

Gavin Finn (1998)

1) $350,000 per "Production Stage" Change Order!!

The Cost of Change

2) One material selection error, but how many change orders to correct the error?



Gavin A. Finn (Prescient Technologies) (1998) "Design Quality - A Prerequisite To Integration Of Design And Manufacturing" at the "NIST - Design/ Manufacturing Integration Workshop: Standards and Implementation Issues"

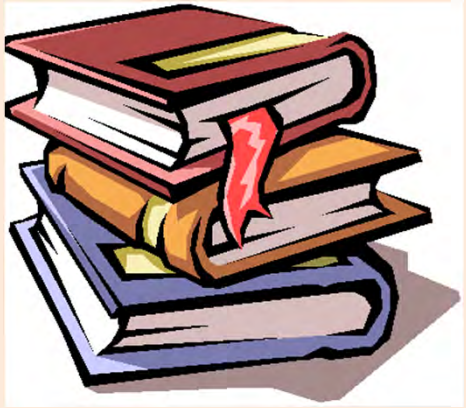
prescient

Aerospace Study
Average Cost per Change

(G, Finn)

1) *$3,500 Design Phase*
2) *$35,000 Build Phase*
3) *$350,000 Production Phase*

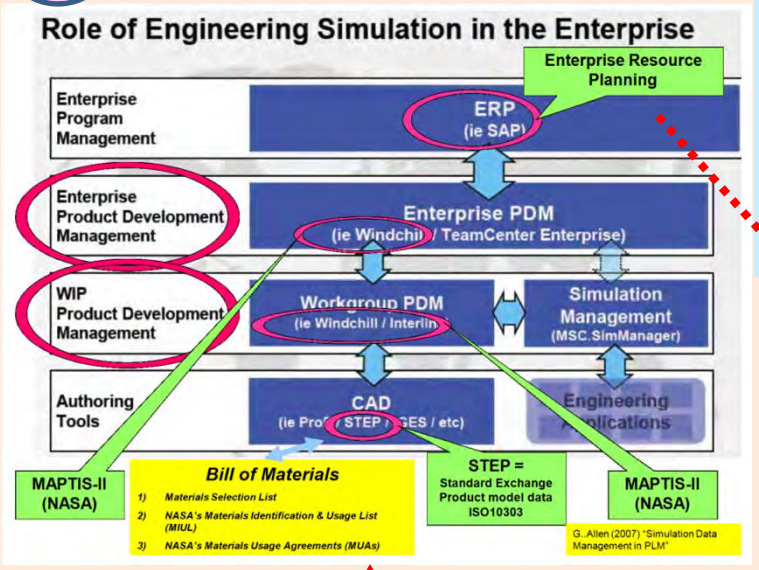
“Leap-Frogging” Technology



MAPTIS and Making Decisions and Controlling Resources (including costs)

1) *Design Engineer (CAD)*
2) *Project/ Program Manager (PLM/ PDM)*
3) *Corporate Executive/ Senior Manager (ERP)*

2



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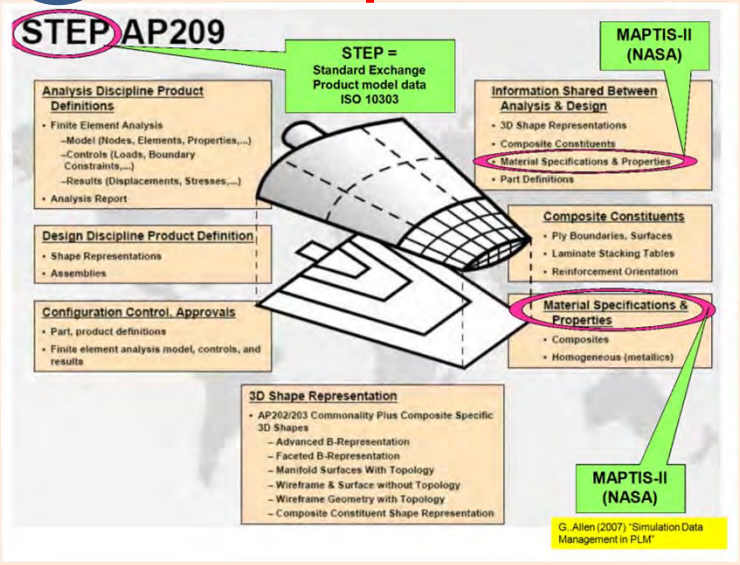

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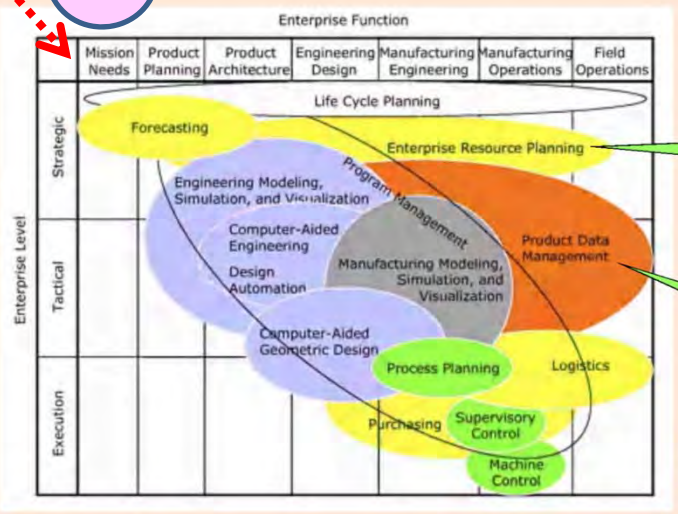


ERP = Enterprise Resource Planning

PDM = Product Data Management

National Research Council (2004) Retooling Manufacturing: Bridging Design, Materials, and Production

Interoperability of AEE Tools

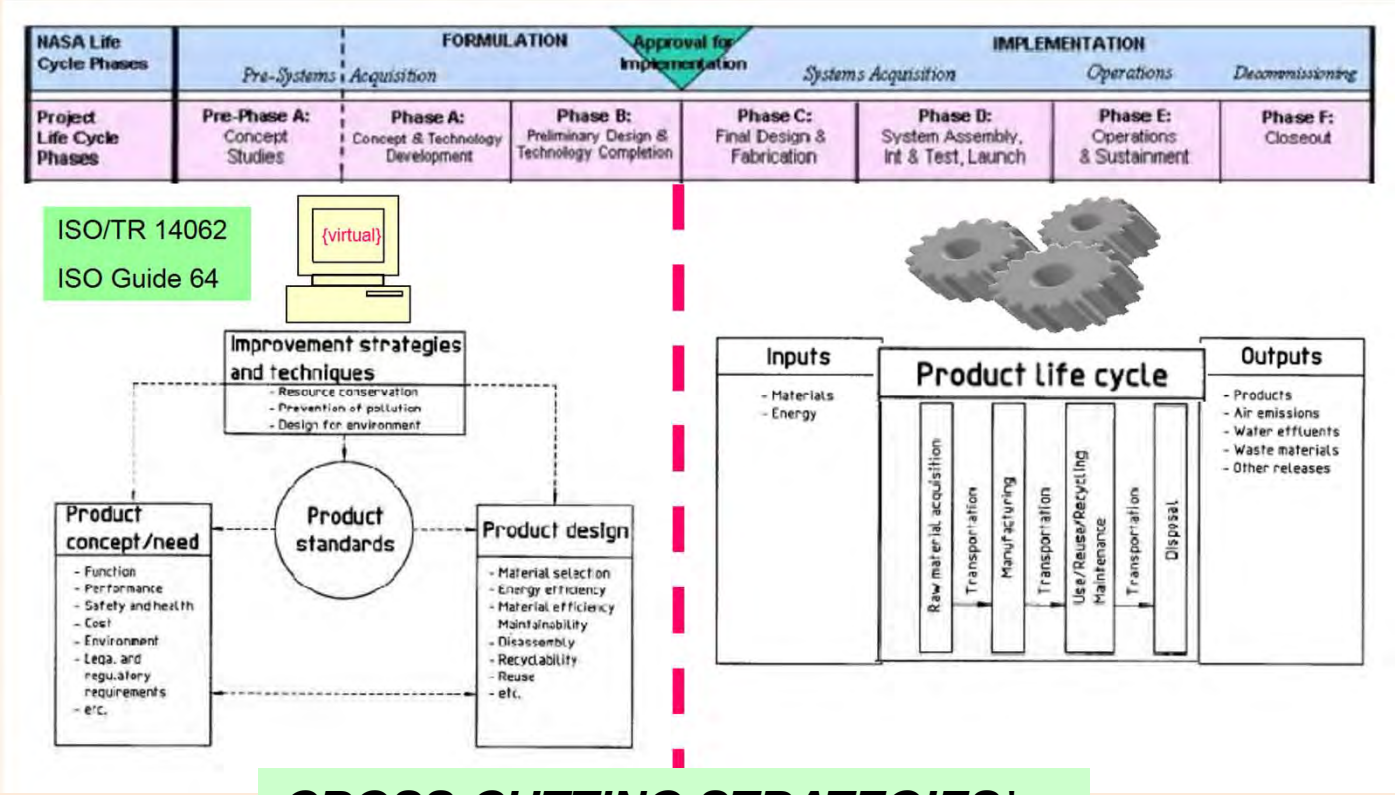
	CAD	CAE	CAM	PDM
CAD	STEP AP203	STEP AP209	STEP NC	
CAE	STEP AP209	STEP AP209		
CAM	STEP NC			
PDM				STEP PDM

http://www.sei.cmu.edu/reports/03tr013.pdf

Company	Siemens	Dassault Systemes	PTC
CAD	UG-NX	CATIA	Pro/Engineer
PDM/PLM	Teamcenter	Matrix One and Enovia	Windchill

MAPTIS and Sustainable Materials Management Opportunities:

<u>Product</u> (Project, Program) <u>Lifecycle Management (PLM)</u>



<u>CROSS-CUTTING STRATEGIES</u>* --

"Technology Roadmap Strategies":

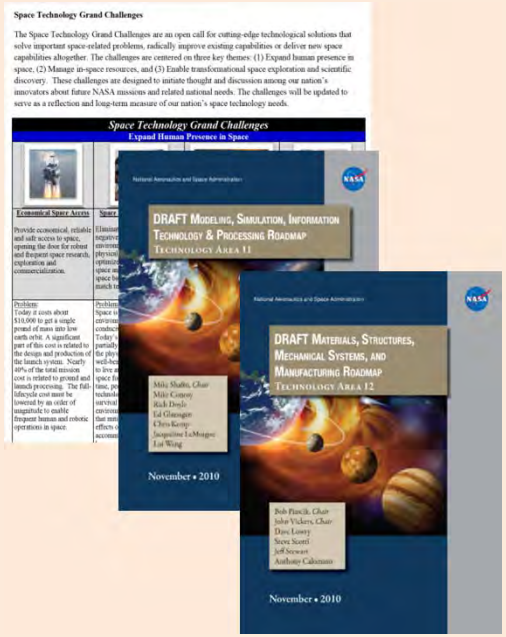
** K. Geiser (2001) <u>Materials Matter</u>*

1. ***Detoxification***
2. ***Dematerialization***
3. ***Decarbonization***

National Initiatives and NASA Technology Initiatives And MAPTIS

MAPTIS can implement concepts that have the potential to significantly contribute to:

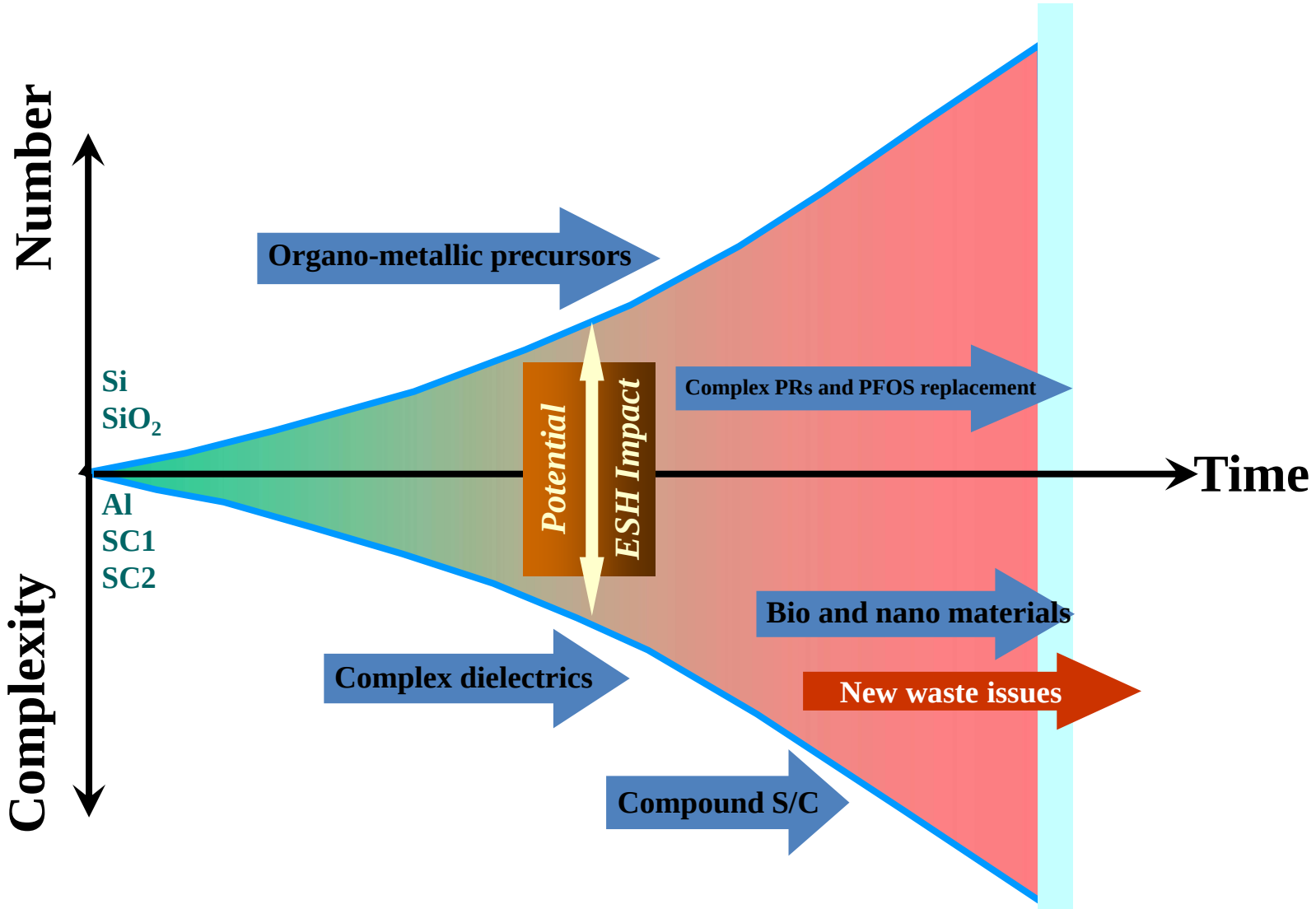
- National Advanced Manufacturing Initiative
- National Materials Genome Initiative



MAPTIS can implement concepts that have the potential to significantly contribute to:

- NASA Space Technology Grand Challenge
- NASA Technology Roadmap for Materials
- NASA Technology Roadmap for Information Technology

Potential Risks of Introducing New Materials



F Shadman (May 2008) EPA Science Forum: Environmental Challenges and Opportunities in Nano-Manufacturing (Semiconductor Manufacturing)

MAPTIS
Public-Private Activities

Spacecraft Materials Consortium

Gary Pippin FFRDC – Aerospace Corp/Boeing (2010) "Spacecraft Materials Consortium" [In attendance on 9 Nov were: Rob Cox, Sopo Yung, Rick Serwecki, Don Jaworske, Debbie Waters, Gary Pippin, Steve Wanthal, Matt Presley, Julia Yefimenko, Iwonka Palusinski, Miria Finckenor, and Kelly Trautz]

09 Nov 2010

The Material Data Management Consortium (MDMC)

MDMC.net
MATERIAL DATA MANAGEMENT CONSORTIUM

Key industry sectors: Aerospace, defense, and energy.

The Material Data Management Consortium (MDMC) is a unique collaborative project focused on developing and applying software to manage mission-critical materials data in the aerospace, defense, and energy sectors.

The Material Data Management Consortium (MDMC)

Members

ASM International
AWE
Boeing
Honeywell Aerospace
GE—Aviation
GE—Energy
Lockheed Martin
Los Alamos NL
NASA Glenn Research Ctr
NASA Marshall SFC
Northrop Grumman
Oak Ridge NL
Raytheon
Rolls Royce
US Navy
US Army Research Labs
Williams International

s industries, it is also vital that
red users, and that data is fully

ts stringent requirements for

The Materials Strategy Software Consortium is a collaborative project that defines and applies new software to manage materials data and meet the challenges of material selection, substitution and cost optimization.

MATERIALS STRATEGY SOFTWARE CONSORTIUM

Benefits include reducing overall manufacturing costs, mitigating the risks associated with global engineering, and improving product quality.

Emerson Electric
Moen Inc. (Fortune Brands)
TRW Automotive
NASA
DePuy
Ethicon Endosurgery
Baker-Hughes
Sulzer
Rhodia
Granta Design

The Materials Strategy Software Consortium

MATERIALS STRATEGY SOFTWARE CONSORTIUM

For any organization with an interest in materials selection, substitution and cost optimization

The Materials Strategy Software Consortium is a collaborative project which defines and applies new software to manage materials data and apply it to the challenges of material selection, substitution and cost optimization.

t / new

market analysis

- **Material Substitution »**
  Tools to identify—and understand the implications of—candidate substitutes for materials which are withdrawn, obsolete or unavailable.
- **Coating Selection »**
  Data and software to support the systematic, rational selection of coatings and coated materials

The Environmental Materials Information Technology (EMIT) Consortium

The Environmental Materials Information Technology (EMIT) Consortium is a collaborative project that develops and applies materials information technology solutions to assist design around environmental constraints.

Two key focus areas are:

- Restricted substance regulations (such as REACH)
- Eco design to meet objectives such as reduced energy or carbon footprint

Members

EMIT CONSORTIUM

EADS Astrium
Emerson Electric
Eurocopter
Honeywell
NASA
NPL
Rolls-Royce
US Army Research Labs

The EMIT Consortium

EMIT CONSORTIUM

The Environmental Materials Information Technology Consortium is for any manufacturing organization.

The project develops and applies materials information technology solutions to assist design around environmental constraints.


STOP